

18th CRC ON-ROAD VEHICLE EMISSIONS WORKSHOP
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Evaluation of High PM Emitting Light-Duty Gasoline Vehicles Using RSD, ASM, and Laboratory Dynamometer Testing

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Motivation

- Normally operating LEV II vehicles have very low PM emissions
- Some vehicles have orders of magnitude more PM emissions
- We need a means of identifying these gross emitters
 - to determine fleet percentages, and
 - to flag for scrap or repair.

Program Design

- **Phase 1** – Test a small population of high emitters at CE-CERT/UCR using CVS, ASM, and RSD (accomplished)
- **Phase 2** – Evaluate RSD PM records obtained from SCAQMD/ESP/FCCC “High Emitter Repair or Scrap Program (H.E.R.O.S.)
- **Phase 3** – Test high PM emitter candidates at referee stations and at ARB laboratories using augmented CVS testing to evaluate the PM emission rates under pre- and post- repair conditions

Phase 1 Program

- Chassis dynamometer testing of 8 high emitting vehicles over Unified Cycle at CE-CERT
- Parking lot testing of these vehicles with RSD systems from ESP and DRI with PM capability
- In-use traffic testing using RSD systems in the field

The results of above tasks have been presented at 17th CRC on-road vehicle emissions workshop, 2007

- Repair and post-testing of subset of high emitter vehicles at CE-CERT

Phase 1 Test Vehicles

#	MY	OEM	Model	Type	Smoke Type	UC PM Rate (mg/mi)	ASM Criteria Gas Results		
							1 st Test	2 nd Test	Failed Emissions
1	1997	Ford	Escort	PC	Normal emitter (no smoke)	1.5 ± 1.1	✓	✓	
2	1985	Toyota	Camry	PC	Light Black (invisible)	25 ± 12	✓	✓	
3	1991	GMC	Sonoma	LDT	Light Blue (invisible)	6.9 ± 3.0	✓	X	HC
4	1981	Toyota	Pickup	LDT	Moderate Blue	860	X	X	HC, NO
5	1995	Dodge	Dakota	LDT	Moderate Black	220 ± 100	X, GP	X, GP	HC, + x
6	1963	Studebaker	Avanti	PC	Heavy Blue	1700 ± 1600	X, GP	X, GP	HC, CO
7	1998	Toyota	Camry	PC	Heavy Black	60 ± 3	X, GP	X, GP	HC, CO
8	1986	Mitsubishi	Max	LDT	Gray	70 ± 11	✓	X	HC, CO

✓ = Pass X = Fail GP = Gross Polluter

**Vehicles in Red Repaired
Retested one year later**

Phase I Repairs

MY	Model	Book	Est. Cost	Repair Needed	Repaired?
1997	Escort	\$2,500	N/A	None	
1985	Camry	\$ 500	\$7,300	Rebuild/new	
1991	Sonoma	\$2,000	N/A	None (Valve guides)	
1981	Toy. PU	\$ 500	\$6,300	Rebuild/new	
1995	Dakota	\$1,500	\$2,200	Fuel and Wiring sys.	*
1963	Avanti	\$9,500	N/A	Rebuild	
1998	Camry	\$6,500	\$2,000	O2 Sensor, Catalyst	*
1986	Max	\$1,000	\$1,700	Valve guide, Carb.	*

Phase I Repairs

	Vehicle Smoke	Vehicle Name	Vehicle Repair	PM mg/mi	Change % of Orig.
1	Baseline	97 Ford Escort	Original no repair	1.5 2.8	86%
2	Inv. Black	85 Toyota Camry	Original no repair	25.2 107.8	327%
3	Inv. Blue	91 GMC Sonoma	Original no repair	6.9 -	-
4	Blue	81 Toyota Truck	Original no repair	619.5 537.9	-13%
5	Black	95 Dodge Dakota	Original Repaired	216.1 18.2	-92%
6	Blue	63 Studebaker Avanti	Original no repair	1718.2 -	-
7	Black	98 Toyota Camry	Original Repaired	60.4 2.5	-96%
8	Grey	86 Mitsubishi Max	Original Repaired	69.6 89.3	28%

Phase 2 Program

- Analyze RSD PM data obtained from SCAQMD/FCCC/ESP H.E.R.O.S. program
- Characterize PM emissions from in-use LDGVs in California
- Characterize “high emitter” cut points
 - by population
 - or by emissions rate

Phase 3 Measurements

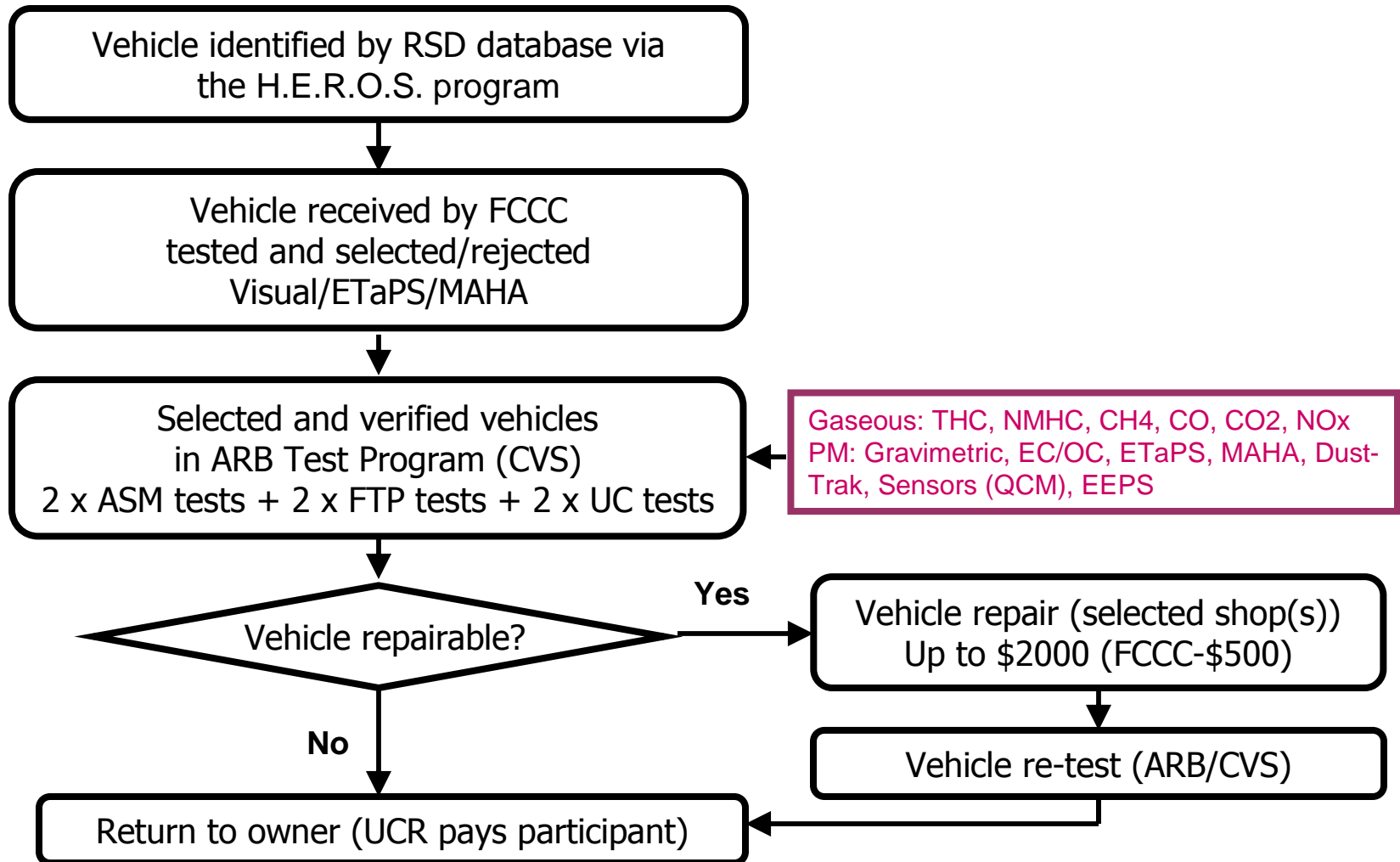
ASM at Referee Stations (FCCC)

- ETaPS: tailpipe, full flow, PM mass
- MAHA: tailpipe, extractive, PM concentration

FTP + UC at HSL (ARB: MSOD, MLD, RD)

- ETaPS: tailpipe, full flow, PM mass
- MAHA: tailpipe, extractive, PM concentration
- DustTrak: CVS, extractive, PM mass
- Teflon Filters: CVS, integrated mass
- Quartz Filters: CVS, integrated OC/EC mass

Phase 3 Program



Time-line

- Phase 2: April ~ October, 2008
- Phase 3: April, 2008 ~ February, 2009
- Preliminarily Results: 19th CRC Workshop
- Draft Final Report: April, 2009
- Final Report: June, 2009